A NON-DESTRUCTIVE TECHNIQUE FOR DETERMINING THE SHAPES *IN SITU* OF PERMINERALIZED SEEDS

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The usefulness of ultrasonography for determining the shapes of embedded permineralized seeds is demonstrated. □*Permineralized seeds, ultrasonics.*

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Outlines of probable peltasperm seeds whose testas are intact but whose contents have been replaced by chalcedony are sometimes exposed on the cut surfaces of 'forest floor', a silicified Mesozoic peat-like material occurring as small boulders scattered on the soil surface or in creek beds in the Miles-Chinchilla-Wandoan region of SE Queensland. As the seeds are rare a non-destructive means of determining their shape was sought. An ultrasonic technique used in optometry to explore the axial dimensions of the eye and the distance between ocular tissues, was employed to determine whether the embedded testa would provide a sufficiently distinct boundary surface for detection by sound waves.

FIG. 1. Transverse section of a cluster of permineralized seeds exposed on the cut surface of QMF31911, x5.

MATERIAL AND METHODS

A slab of 'forest floor' with seed outlines exposed on its surface (Fig.1) was mounted on a horizontal stage above which was an ultrasonic probe. When the probe is placed in contact with each seed, sound waves penetrate the medium and are returned from acoustically reflective boundaries. The elapsed reflection time allows distance within the medium to be established. Velocity of the sound waves in chalcedony was assumed to be similar to that in crystalline quartz, namely, 5720m/s (Kaye & Laby,1973). In other applications, this technique has been shown to be accurate to ±0.15mm (Rudnicka et al.,1992). For selected seeds, ultrasonography was performed at 0.5mm intervals along traverses 0.1mm apart, and disposed at right angles to the long axis of the seed outline. The data were logged and transformed into images imposed on a three dimensional 1mm grid using the Microsoft Excel graphics software. To check the reliability of the technique a section was made through one of the seeds at right angles both to the

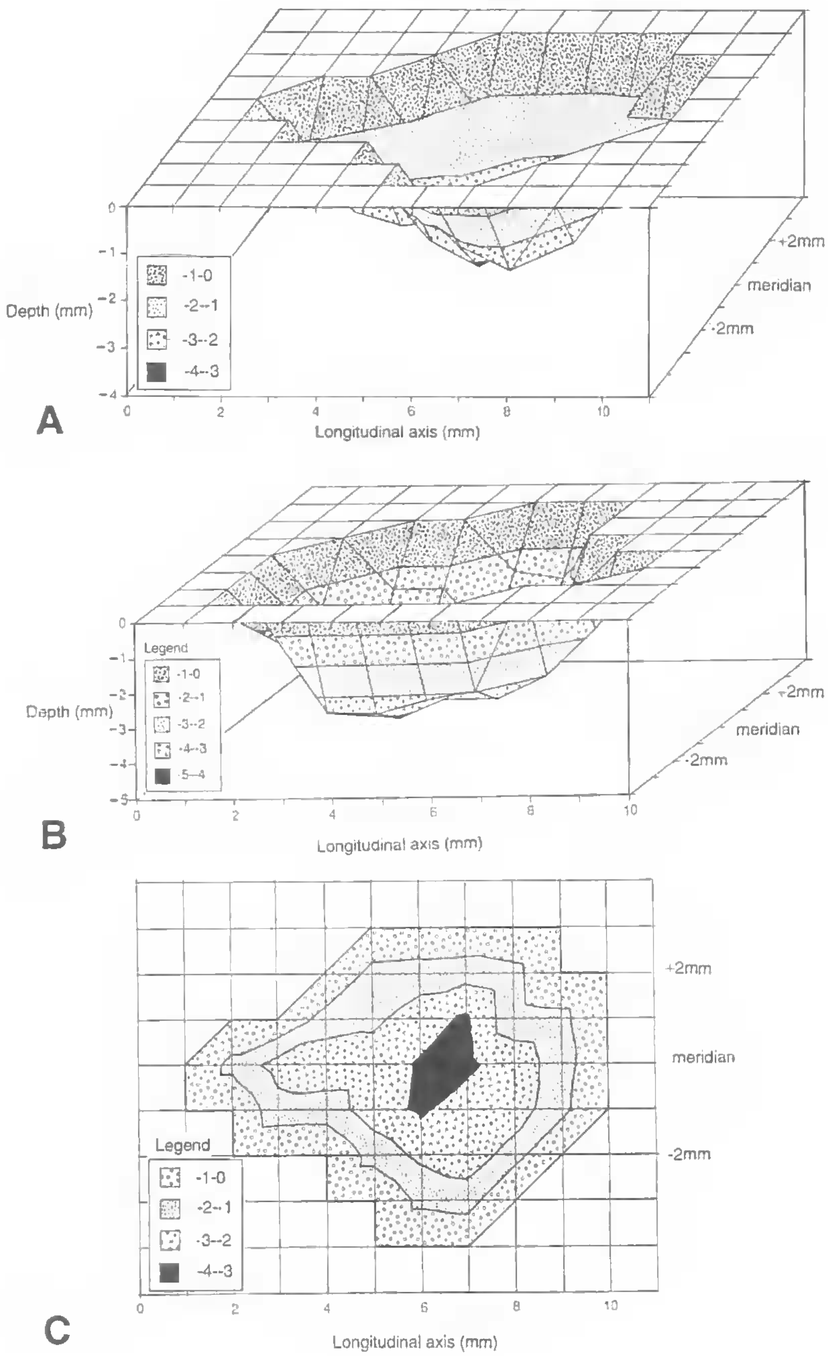

FIG. 2. Three dimensional ultrasonographs of a partial seed whose outline is exposed on the surface of a slab cut from a boulder of permineralized "forest floor". A,B, oblique-lateral views ; C, surface view.

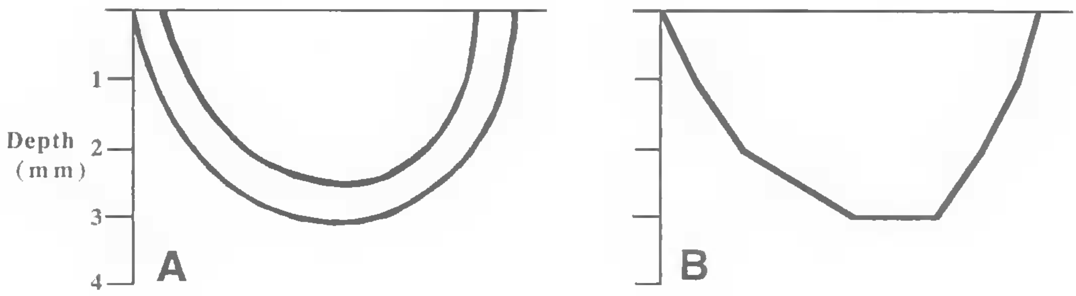

FIG. 3. Shape of the partial seed of Fig. 2 as seen in transverse section 7, to the right along the longitudinal axis. A, outline of testa on surface; B, outline of seed as indicated by the position of the acoustic reflecting boundaries as given in Fig. 2C.

plane of its exposed surface and its longitudinal axis. The shape of the embedded portion of the seed was thereby revealed.

RESULTS

Three views of a partial seed determined by this method (Fig.2) may be compared with the real shape by comparing individual traverses (Fig. 3).

DISCUSSIONS

Close correspondence between the predicted and observed shape of the embedded seed investigated confirms the capacity of ultrasonography to distinguish boundaries between fossil seeds and the matrix in which they are embedded. The technique merits further investigation to determine whether ultrasonography is applicable to the study of other permineralized fossils.

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